Observer Goals Modulate Information Integration in the AON: Evidence for Dual Pathways

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Introduction

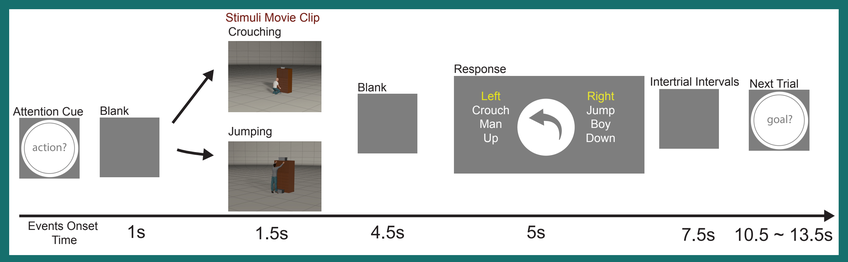
Background: Dual AON pathways are proposed for action observation, one routed through the mirror system (Rizzolatti & Matelli, 2003) and a ventral pathway through semantic and conceptual networks (Buxbaum & Kalenine, 2010).

Study Goal: To dissociate the pathways supporting action recognition vs goal inference by examining two key features of neural representations: connectivity vs the BOLD univariate response.

Secondary Study Goal: these are functionally heterogeneous areas, so we are analyzing the regions at a parcel level to characterize the underlying functional system.

Methods

Stimuli and Tasks:



Subjects: 24 participants.

Scanning: 3T Siemens Prisma at FIBRE, University of California Irvine

Stimuli and Task: Vignettes of an avatar jumping up of crouching down (action) to reach a box on the top / bottom (goal). Task was to attend cued features and report the depicted action or goal.

Functional Connectivity seed: pSTS, identified through independent localizer scans collected in the same session.

Other ROIs: IFG, aSTS, and parietal cortex, identified using whole brain betaseries connectivity with the pSTS as the seed.

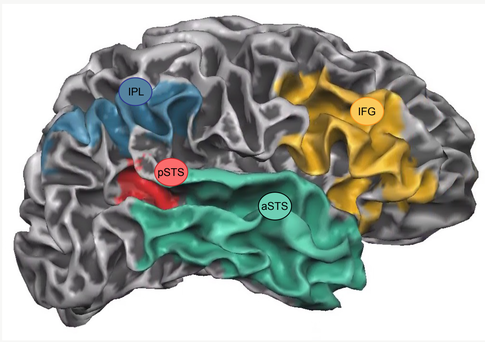
Functional Connectivity: Conducted parcel-wise, using the beta-series for each experimental condition.

Network characterization: Glasser et al. (2016) parcellate each ROI, network identified using Kong et al. (2022) 17 network systems.

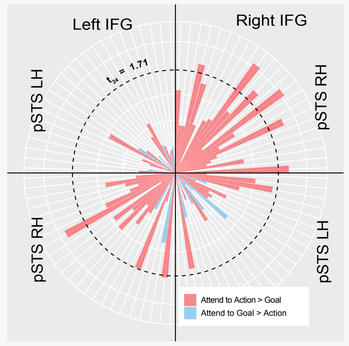
Funding:
This study was supported by the National Science Foundation BCS-1658560 to EG and BCS-1658078 to JP

Results

1. Whole-brain connectivity to right pSTS seed ($p < 0.01$ uncorrected)

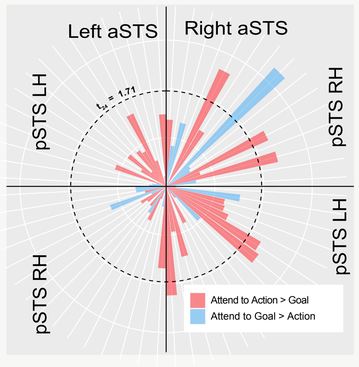


2. Modulation of connectivity by task: IFG and the pSTS



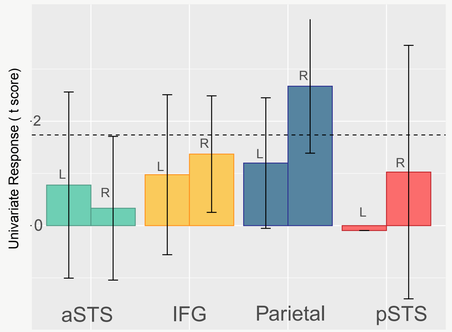
Increased FC between right pSTS and bilateral IFG when attending to actions.

3. Modulation of connectivity by task: aSTS and the pSTS



Increased FC between bilateral pSTS and right aSTS when attending to actions.

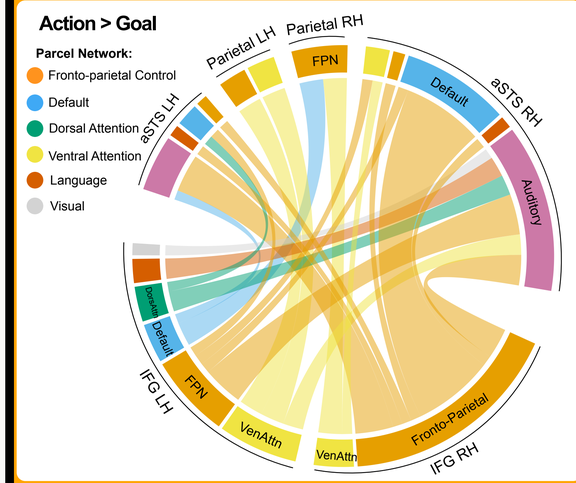
4. Modulation of univariate BOLD by task: All ROIs (right hemisphere)



Parietal (R) : Goal> action ($t = 2.67$, $p < 0.01$)

pSTS and aSTS: n.s. effect of tasks.

5. Network characterization: IFG, Parietal and aSTS



IFG and parietal parcels modulated by task most strongly linked to the fronto-parietal control network (FPN).

aSTS parcels most strongly linked to default mode (DMN) and auditory cortex (STG).

References

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Conclusion

Cognitive context modulates co-activation between pSTS, aSTS and IFG:

- Connectivity is strengthened between pSTS and IFG, pSTS and aSTS when attending to action kinematics.
- This modulation is distinct from neural populations representing action goals in parietal cortex.
- Modulation is most apparent in the right hemisphere and in the fronto-parietal control network.